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A market for renewable energy credits in the Indian power sector

Anoop Singh *

Department of Industrial and Management Engineering, Indian Institute of Technology Kanpur, Kanpur 208 016, India

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Abstract

Electricity generation from renewable energy sources in India has been promoted through a host of fiscal policies and preferential tariff for electricity produced from the same. The fiscal policies include tax incentives and purchase of electricity generated through renewable energy sources. The enactment of the Electricity Act 2003 (the Act) has lent further support to renewable energy by stipulating purchase of a certain percentage of the power procurement by distribution utilities from renewable energy sources. The renewable portfolio obligation as well as the feed-in tariff for power procurement has been specified by a number of State Electricity Regulatory Commissions (SERCs) for the respective state under their jurisdiction. A feed-in tariff determined through a cost-plus approach under a rate of return framework lacks incentive for cost minimisation and does not encourage optimal utilisation of renewable energy resources in the country. Such regulatory provisions differ across states.

The prevalent practice of fixing a renewable portfolio obligation along with cost-based feed-in tariffs disregards economic efficiency. The paper proposes nationally tradable renewable energy credits scheme for achieving the targets set by the respective SERCs as renewable portfolio obligation. This would reduce the cost of compliance to a renewable portfolio obligation, and would encourage efficient resource utilisation and investment in appropriate technologies. The paper highlights its advantages and implementation issues. This paper discusses regulatory developments for promotion of renewable energy in various Indian states. The paper also identifies a number of issues related to regulations concerning renewable portfolio obligation.

Keywords: Renewable portfolio obligation; Renewable energy credits; India

Contents

* Tel.: +91 512 259 7679; fax: +91 512 259 7553.
E-mail address: anoops@iitk.ac.in.

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1. Introduction

The electricity supply industry has undergone through a process of reform in a number of developed as well as developing countries over the last two decades. The reforms process is often are intended to improve the investment climate and enhance competition. This also includes setting up of in the power sector along with setting up of independent regulatory institutions. In a competitive market framework, electricity generate from renewable energy sources faces the challenge on account of cost, reliability as well as system integration. While a significant share of electricity supply continues to be dependent on conventional sources (both fossil and non-fossil), the development of renewable energy has been encouraged due to the associated environmental, sustainability as well as socio-economic benefits. The development of renewable energy sources is often supported by financial subsidy and fiscal incentives, and by mandating its use. The Kyoto protocol has brought a new lease of life for investment in renewable energy in developing countries by improving its viability and encouraging research to enhance their cost competitiveness.

The Indian power sector has witnessed reforms since the sector was first opened for private investment in the early 1990s [1]. The policy framework for investment in renewable energy sources for electricity generation has been supported with fiscal incentives, and preferential procurement and pricing. This has largely been a voluntary approach guided by guidelines of the Ministry of Non-conventional Energy Sources (MNES), now known as the Ministry of New and Renewable Energy (MNRE). The Electricity Act 2003 (the Act) has enabled competition in the Indian power sector in bulk as well as retail electricity supply. The Act also mandates promotion of co-generation and renewable energy sources.

The renewable portfolio obligation (RPO)[1] as well as the feed-in tariff for power procurement has been specified by a number of State Electricity Regulatory Commissions (SERCs) for the respective state under their jurisdiction. Renewable portfolio obligation with cost-based feed-in tariffs disregard economic efficiency [2,3]. A feed-in tariff determined through a cost-plus approach under a rate of return framework lacks incentive for cost minimisation and does not encourage optimal utilisation of renewable energy resources in the country. Such regulatory provisions also differ significantly across states and lack standarisation of tariff determination methodology adopted by the respective SERCs.

The Electricity Act 2003 and the National Electricity Policy (NEP) provide for competitive procurement of power generated from renewable sources of energy by the electricity distribution companies. However, the regulatory developments following the Electricity Act 2003 continue to shield inefficiencies by promoting cost-plus tariff for an assured off-take up to a prescribed limit. While renewable energy would continue to demand government support due to cost and technological disadvantages, the scope for cost reduction and operational efficiency cannot be neglected.

In this paper, we propose nationally tradable renewable energy credits for achieving the RPO prescribed by the respective SERCs in India. This would help to minimise cost of power procurement, and lead to efficient resource utilisation and investment in appropriate technologies. The paper discusses the key policy and regulatory developments that promote generation of electricity from renewable energy sources in a number of states in the country. These include the prescribed RPO, and the important terms and conditions of tariff determined for the same. We also highlight a number of advantages of tradable renewable energy credits and identify a number of issues related to their implementation of such a scheme in the country.

2. Renewable energy in the Indian power sector

The renewable energy has been promoted for use in various applications in India including electricity generation, cooking, heating, water pumping for industrial, domestic as well as commercial applications. Development in technology and a host of promotional policies have helped adoption of renewable energy sources in electricity generation in the country. As on 31st January 2007, total renewable energy-based electricity generation capacity in the country is estimated to be 9497 MW including 9373 MW of grid interactive capacity. Over 66% of the renewable energy capacity this is accounted by wind mills (Fig. 1).

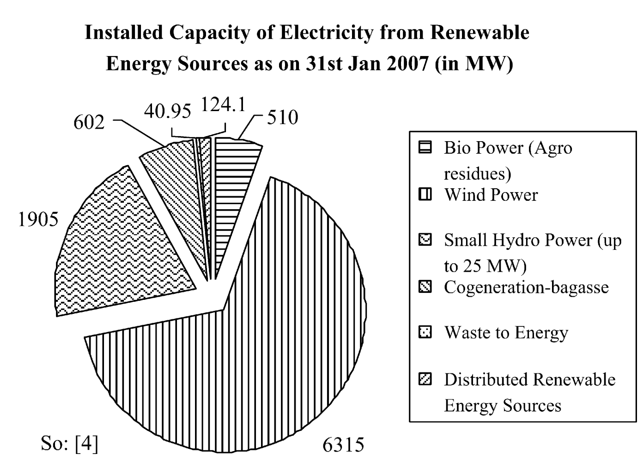


Fig. 1. Installed capacity of electricity generation from renewable energy sources.

[1] This is also referred as the Renewable Portfolio Standard (RPS) in the US.

The growth of investment in development of renewable energy sources in India has been supported through a host of fiscal incentives and other promotional policies. These include 80% accelerated depreciation (which was 100% earlier) for tax purposes in the 1st year of the installation of the project, nil excise duty on manufacture of most of the finished products for utilisation and low import tariffs for capital equipment. Apart from this, a 5-year tax holiday is also provided for power generation projects using renewable energy sources. As per the guidelines of the MNES, the state utilities encouraged renewable energy by offering remunerative price for power purchase and providing facilities for facility for banking. The Electricity Act 2003 has furthered the cause of renewable energy through a number of enabling provisions as discussed in the next section.

3. The Electricity Act 2003 and policy framework for renewable energy

The enactment of the Electricity Act 2003 has deepened the process of reform in the Indian power sector and has enabled competition in the Indian power sector in bulk as well as retail electricity supply, in phases [1]. To meet the challenges in the emerging competitive environment, the Act promotes electricity generation from co-generation and renewable energy sources through following enabling provisions:

(i) The SERCs to specify, for purchase of electricity from such sources, a percentage of the total consumption of electricity in the area of a distribution licensee (Sec. 81(1)(e)).
(ii) The SERCs to promote co-generation and generation of electricity through renewable sources of energy by providing suitable measures for connectivity with the grid and sale of electricity to any persons (Sec. 81(1)(e)).
(iii) The terms and conditions for the determination of tariff to be prescribed by the SERCs to promote co-generation and generation of electricity from renewable sources of energy (Sec. 61(h)).
(iv) The National Electricity Policy (NEP) to be formulated by the central government, in consultation with the state governments for development of the power system based on optimal utilisation of resources including renewable sources of energy (Sec. 3(1)).
(v) The central government to prepare a national policy, in consultation with the state governments, permitting stand-alone systems (including those based on renewable sources of energy and other non-conventional sources of energy) for rural areas (Section 4).

Subsequent to the enactment of the Act, the SERCs have specified a RPO and have specified feed-in tariff and other terms and conditions to promote co-generation and generation of electricity from renewable energy sources.[2] These are further discussed in the section following Section 5.

[2] Hereinafter, the scope of 'renewable energy' would also include co-generation of electricity.

A national policy permitting stand-alone systems using renewable energy has been notified by the Ministry of Power in 2006. This policy provides guidelines for setting up of such systems for off-grid systems in rural areas in the country, and specifies tariff forbearance for electricity supply to consumers in these areas and other regulatory dispensations applicable in this context.

4. Regulatory issues in promotion of renewable energy

The implementation of the RPO as envisioned in the Act is to be guided by the regulatory provisions issued by the respective SERCs. A number of SERCs have specified such an obligation as a proportion of total procurement of power by the distribution companies. The SERCs are also empowered to prescribe a tariff for procurement of electricity from such sources unless these are procured on a competitive basis. For the effective implementation of the mandate for promotion of renewable energy, the SERCs need to address the following issues:

(a) Qualifying definition of renewable energy and co-generation.
(b) An overall procurement obligation vs. source/technology-specific obligation.
(c) A minimum and/or maximum level of RPO.
(d) Provision for rollover of under or over-achievement of the RPO. Penalty for failure to meet the RPO.
(e) Procurement from outside the state to meet the RPO for utilities within a state.
(f) Tariff for electricity procured for meeting the RPO and, the related terms and conditions some of which are listed below:
  - tariff for firm and non-firm electricity (single or two-part tariff) including basis for determination of tariff'
  - differentiation between existing and new facilities;
  - period for tariff review so as to provide a regulatory certainty;
  - voltage level for inter-connection;
  - investment and cost sharing for inter-connection infrastructure;
  - wheeling charges for self-use or for third-party sale;
  - transmission loss for use of transmission facilities for self-use and third-party sale;
  - reactive charges;
  - energy banking—period for energy banking and rollover option, time of the day (TOD) or frequency-based banking and drawal, banking charges, period of extinguishing banked energy and treatment for purchase of unutilised banked energy'
  - conditions for third-party sale.
(g) Exemption from merit ordering.
(h) Applicability of intra-state availability-based tariff (ABT).
(i) Sharing of benefits under the clean development mechanism (CDM).
(j) Sunset clause to limit support for renewable energy up to a limited period.

Table 1
Renewable portfolio obligation, applicable tariff and other terms and conditions

	Andhra Pradesh[@]	Gujarat	Karnataka	MP	Maharashtra[@]	Orissa	Rajasthan[@]	TN	UP
Renewable portfolio obligation (as a percentage of total procurement of the distribution licensee in a year)	5 (2005–2006 to 2007–2008); wind 0.5 (included above)	1 (2006–2007); 1 (2007–2008); 2 (2008–2009)	Min. 5; Max. 10	0.5	3 (2006–2007); 4 (2007–2008); 5 (2008–2009); 6 (2009–2010)	3 (2007–2008); 3.5 (2008–2009); 4 (2009–2010); 4.5 (2010–2011); 5 (2011–2012)	Wind[$] 2 (2006–2007) + 0.3 pa till max. 4; biomass[$$] 0.37 (2006–2007); 0.83 (2007–2008) + 0.3 pa till max. 2; solar[$] up to 50 MW; others 25 MW	10	7.5
Tariff for renewable energy (Rs./kWh)	Wind and MSW—3.37 + 5% pa; base price as on 1 April 2004; incentive of Paise 21.5 kWh^{-1} for PLF exceeding 55% (baggasse-based cogen), 80% (biomass), 35% mini-hydel	3.37 (new wind mills for up to 20 years since COD); existing as per the PPA; in-firm injection at UI rate of the state	Wind—3.4; mini-hydro—Av. 2.8 (for 10 years); biomass—2.85 + 2% simple pa; bagasse cogen—2.80 + 2% simple pa; existing as per PPAs approved by the commission; priority for purchase to plants with earlier COD	3.97 (1), 3.80 (2), 3.63 (3), 3.46 (4); 3.3 (5–20)	Wind—Pre-1999; 2.25–4.01 (1994–1995 to 2013–2014); wind—1999–2003; 2.80–3.9 (8 year schedule); wind—new 3.50 in 1st year; +0.15 for 13 years; (3.5–5.3) 2003–2004 to 2015–2016; non-fossil fuel-based cogen—3.05 + 2% pa compounded; biomass—3.04 for 2005–2006 to 3.43 for 2017–2018; mini-hydro	NA	(as per Govt. of Raj. Policy); wind—(for projects commissioned after 23 February 2006); 3.25 + 0.06 for 10 years; 3.79 from 11 to 20 years; other renewables (for COD 2004–2005) 3.32 + 2%; up to 2013–2014	Wind—2.75, 2.90; biomass and Bagasse-based cogen 3.15	Bagasse/biomass cogen; 2.86–3.38 for 2006–2010 depending on year of COD; mini/micro-hydel 3.39–1.90 for 1st to 20th year of operation.; others 2.5; in-firm 1.42 (+4% pa); incentive of Paise 21.5 kWh^{-1} for PLF >55% (baggasse-based cogen), 80% (biomass), 35% mini-hydel
Banking	2%	Existing wind—6 months banking over three parts of the day; new wind—monthly banking			Banking and drawal against TOD tariff slots; wind—banked energy to be utilised within a year. Surplus up to 10% excess to be bought at lowest TOD slab for HT cons., rest at wtd. av. fuel cost	Only for captive generators.	Not for self-consumption; for third-party sale—quarter-wise for non-firm, and monthly for firm power; balance at 60% of HT industrial tariff;	Within a year (April–March) only for Wind; 5% charges for banking; unutilised 'banked' energy deemed to be purchased at 75% of the normal wind energy tariff	Banking during 17.00–22.00 h and drawal during rest of the day; utilisation within same or following FY; rest to be treated as sale; banking charge 12.5%
Transmission and wheeling charges	2%	Tr. charges and losses (4% in kind for self-use, sale to discom or third-party)	As per applicable t erms and conditions	As per applicable terms and conditions	As per terms and conditions; wheeling 2%; Trans. loss 5%	As per applicable terms and conditions	50% of normal wheeling charges; Trans. loss for third-party/captive use 4.5% on EHV and 8.3% for <132 kV	In kind; 5% (wind); biomass and cogen (3–6%); rebate for high voltage injection	Nil for sale to discom? For 'open access' case, as per the OA regulations
Sharing of CDM benefits	Not elaborated	25% of gross CDM benefits to be shared with discoms	All CDM benefit to the developer	Not elaborated	Wind – Yes to be shared between developer, utility and consumer when case arises; cogen—not mentioned	Not elaborated	25% of the CDM benefit to be shared with discoms; from 2007 to 2008	Not elaborated	All CDM benefit to the developer

Penalty for non-compliance (Rs./kWh)	Yes; not if due to non-availability within the specified tariff. Penalty to be used by NEDCAP for promotion of RE and conservation	Shortfall to be added to next year's target; waiver in case of supply constraints or any other uncontrollable factor	No	No	0 (2006–2007); 5 (2007–2008); 6 (2008–2009); 7 (2009–2010)	No	RE surcharge—Rs. 3.59 kWh^{-1} (for 2007–2008). To be utilised by STU for creation of trans. infra. for RE; power plants	No	No
From outside state	No; ok from other discoms within state	From outside the license area but within the state	Within the state only		From outside the license area but within the state		Within the state only	Does not seem to prohibit	? not specified

So: compiled by the Author from respective regulations/orders of the SERCs [6–17]. *Notes*: $—non-firm; $$—firm; @—the RPO also applicable to captive and open access consumers.

(k) Bidding conditions and price caps for competitively procured electricity to meet the RPO.

While some of the SERCs have issued comprehensive regulations defining almost all the above characteristics; others have not addressed these as comprehensively. A perusal of the applicable terms and conditions for the RPO as discussed in the next section reveals that such regulations differ widely across various states.

5. Regulatory provisions for electricity procurement from renewable energy sources

Subsequent to enactment of the Electricity Act 2003, SERCs in a number of states have issued state-specific regulations specifying a RPO as a percentage of electricity purchased by distribution licensees to be procured from co-generation and renewable energy sources. Apart from this, the SERCs have also issued tariff orders that specify a feed-in tariff for purchase of electricity generated from co-generation and renewable sources of energy. A summary of the regulatory framework specifying the RPO, the feed-in tariffs, and other terms and conditions applicable in nine large Indian states is given in Table 1. There is a wide divergence in terms of the RPO applicable in different states. This ranges from as low as 0.5% for Madhya Pradesh to as high as 10% for Tamil Nadu. As per the provisions of the National electricity Policy, these obligations need to be increased in future. The prescribed level of renewable portfolio standard for some for the of states in US are—California 20% by 2017, Nevada 20% by 2015, New Mexico 10% by 2011, Texas 5% (2015) and New York 25% by 2013. The RPS for some of the smaller states are—Massachusetts 4% by 2009, DC 11% by 2022 and New Jersey 6.5% by 2008 [5].

The level of RPO prescribed by SERCs in various Indian states is primarily guided by the potential for development of renewable energy sources within the state, their existing utilisation and proposed/expected investment. The existing regulatory environment ring fences the renewable obligation within a state as the distribution utilities are expected to meet this obligation form purchase of electricity generated from co-generation and renewable energy sources within the state itself. When procurement of electricity generated from non-renewable sources of energy can be undertaken from outside the state, the exiting policy framework does not bar the distribution utilities from procuring electricity form renewable energy sources located outside the state. The feed-in tariff specified for electricity procured under the RPO is of a cost-plus nature. The basis for determination of tariff by the respective SERCs, in general, includes a justifiable investment in an appropriate technology, an inflation indexed variable cost, a normative debt-to-equity ratio and a 'reasonable' rate of return on equity. While there are some common factors in the tariff determined so by various SERCs, there is often a wide divergence in the level of parameters used as an input to such an exercise. While a normative 70:30 debt-to-equity ratio is adopted, the 'reasonable' rate of return on equity ranges from 14 to 16%. Such a rate of return regulation is often criticised for overinvestment and lack of

incentive for improvement in efficiency of operations. Most of the conventional power generation projects in India have been awarded through a Memorandum of Understanding route. Recent development shave led to adoption of a tariff-based bidding exercise, which imbibes a competitive spirit and drives cost minimisation by bidders to the project. For large projects, such a competitive process bears fruits in terms of driving down the cost of power procurement by the distribution utilities. In the case of renewable energy-based projects, the projects tend to be small in size and numerous in numbers. This makes it difficult to award each individual project to private developers on a competitive basis. Numerous private developers have invested in development of a number of small renewable energy-based electricity generation projects, which sell electricity to the utilities on an MoU basis as per agreed power purchase agreement which are now guided by the feed-in tariffs specified by the SERCs. The distribution utilities can, however, seek competitive procurement of electricity generated from renewable energy sources as envisioned in the National Tariff Policy. The segmentation of the RPO by technology as prescribed by some of the SERCs, and significant difference in the cost and hence the feed-in tariff across these technologies, makes competitive procurement a challenging task. In this context, 'renewable energy credits', which can be traded separately from the electricity produced using renewable energy sources could help address the issues identified above. This would also encourage competition among various energy sources to minimise cost and provide appropriate incentive for development of cost effective renewable energy sources. We propose that a national market for renewable energy credits can be developed in India even while the level of RPO prescribed by various SERCs may differ across various state and could remain technology specific. We address a number of implementation issues in the next section.

Since the distribution companies would enter into a power purchase agreement with the respective developer of renewable energy, various terms and conditions for tariff need to enshrined in that agreement. In the absence of a standarised power purchase agreement prescribed by the respective SERC, the route to negotiation on key terms and conditions of tariff causes delays and may result in non-favourable outcomes.

6. A market for nationally tradable renewable energy credits

The international practice in promoting renewable energy sources include renewable energy portfolio obligations, non-fossil-fuel obligations, feed-in tariffs, green certificates, tax incentives and subsidies [5,18]. The feed-in tariffs provide an assured off-take tariff for electricity produced using renewable energy sources. The UK's NFFO involves a tendering process, wherein producers compete in terms of price to supply a specified quota of electricity separately for different renewable technologies. In a market friendly approach as practiced in some of the states in the US, the generators could demonstrate compliance for RPS. RPO through ownership of 'Renewable Energy Credits' or 'Green Certificates', which can accrue from own investments or could be traded in the market. Apart from a number of states in the US [3,5,19,20], Australia [19], and some European countries [3,19] also allow tradable renewable energy credits to fulfil regulatory obligations towards deployment of renewable energy. Japan is also proposing to allow similar tradable certificates to meet the renewable energy obligation of retail suppliers [21]. The feed-in tariffs have been able to provide adequate incentive for investment in development of renewable energy sources for electricity generation especially in Germany. However, this may loose the race to a pan-European trading regime for renewable energy credits [2].

The present regulatory disposition for promotion of renewable energy for electricity generation in India is through state-specific RPO with cost-based feed-in tariffs characterises a usual lacuna with the rate of return regulation in its ability to provide incentive to minimise cost. This also stifles innovation and technology development to reduce costs. In a rate of return regulatory framework, information asymmetry also continues to be a challenge for regulatory institutions, which allow costs that are deemed to be 'reasonable'. As an alternative to this, a market for 'tradable renewable energy credits' would promote renewable energy in a competitive manner that would address the problems associated with the above information asymmetry. The National Tariff Policy also prescribes that procurement of electricity from renewable energy sources to be done, as far as possible, under competitive bidding process within suppliers offering electricity from same type of non-conventional sources [22]. The policy also stipulates that in the long-term, these technologies need to compete with other sources in terms of full cost.

We propose that a market for national tradable renewable energy credits can be developed in India to further the cause of renewable energy in an efficient and cost effective manner. Such credits can be traded separately in commodity exchanges while avoiding costly transmission of 'renewable' electricity over the grid. Another approach would be to allow tradability of 'renewable' electricity, which bundles 'renewable credit' with 'electricity'. Such bundling limits tradability due to its dependence on availability of transmission network and the influence of transmission cost and transmission losses. Nationally tradable renewable energy credits, which could be sold separately from 'electricity' addresses these issues effectively. Separation of 'energy' and 'renewable credit' market promises a high degree of economic efficiency [2,23].

In the proposed scenario for nationally tradable renewable energy credits (REC), a distribution licensee can meet its RPO for given year by:

(a) Generating electricity using eligible renewable energy sources for sale in the license area.
(b) Purchasing electricity generated using eligible renewable energy sources from generators within and/or outside the state.[3]

[3] Presently, the SERCs bar distribution licensee from procuring electricity generated from renewable energy sources from outside the state to meet their RPO.

(c) Purchasing credits from electricity generated or procured by another distribution licensee in excess of its obligation.
(d) Rolling over its obligation to the next year, if permitted by the SERC.
(e) Benefit from excess procurement undertaken in previous year, if its rollover from the previous year is permitted by the SERC.

In the proposed scheme, the electricity can be traded separately from renewable energy credits (RECs). This separation would provide a number of advantages to the project developers, the distribution utilities, the regulators as well as the society as whole. As compared with the traditional RPO with feed-in tariffs, a nationally tradable renewable energy credits regime in India offers the following advantages.

6.1. Transmission cost and congestion

Tradable credits for electricity generated from renewable sources do not require its transmission over long distances, hence reducing transmission costs and congestion. Such electricity can be consumed locally and only credits need to be transferred to distribution utilities under obligation. Even if the SERCs allow procurement of electricity from renewable energy sources located outside a state, it would necessitate additional cost burden due to transmission cost and transmission losses. Further, this may add to the existing congestion especially in the intra-state transmission network that has not been able to catch up with the required investment. The nature of electricity generated from some of renewable energy sources like wind, solar, tidal is in-firm and there are also fuel supply risks associated with biomass-based plants. This would make it difficult to secure and retain transmission corridor that has a risk of being unutilised or underutilised. As the existing CERC regulations, the allocated transmission capacity in such cases may need to be surrendered.

The existing/potential open access customers have been facing difficulties in obtaining open access to the intra-state transmission network due to operational and technical constraints. In case of more than one distribution licensee within a state, the existing regulations of the respective SERCs permit procurement of electricity from renewable energy sources from outside the license are but within the state. The transmission of electricity from renewable sources from the one license area to the other would entail transmission cost and transmission loss as well as potential unavailability/congestion of the intra-state transmission network.

6.2. Promotion of stand-alone systems based on renewable energy

Since trade in renewable credits does not require physical transmission of electricity, the additional revenue from sale of credits could help improve viability of stand-alone systems. In the existing scenario, it may not be economical to transmit electricity from such regions. The Rural Electrification Policy, issued in conformance with the Electricity Act 2003, lays down basic policy framework for stand-alone systems for rural areas [24]. The SERCs would lay down guidelines for such a system based on various technologies. Such guidelines may also incorporate appropriate treatment of renewable energy credits so as to further promote rural electrification by developing stand-alone systems based on renewable energy sources.

6.3. Competitive participation in electricity markets

Unbundling of ‘renewable energy credit’ from ‘electrical energy’, would improve competitiveness of renewable energy-based generating systems, which have cost disadvantages. The revenue from ‘renewable energy credits’ can partially help address the cost disadvantage for such renewable energy technologies and help these compete against traditional technologies. Availability of cost competitive electricity from such sources would improve the competitive environment in the power sector, in general. There may, however, be regulatory concerns as the revenue from renewable energy credits could be considered as an implicit subsidy, which distorts competition in electricity markets. This may desire appropriate regulations granting exemptions in such cases including those on account of revenue received from the CDM.

6.4. Widening participation beyond distribution licensees

The RPO prescribed by the SERCs is applicable largely to the distribution licensees in the Indian context. In a few cases, the open access as well as the captive consumers are also obliged to meet such a stipulation. The additional cost due to costly power purchase from renewable energy sources is effectively allocated to all consumers in the area of a distribution licensee. Environmentally concerned consumers may be willing to consume a higher proportion of ‘green electricity’[4] than the prescribed level of RPO by the regulator. Such consumers can purchase renewable energy credits. This would result in additional demand for renewable energy credits and hence may promote further investment. Tradability of renewable energy credits would allow wider participation by philanthropic organisations, NGOs and development agencies. The corporate sector may also wish to purchase renewable energy credits as a part of their social corporate responsibility.

6.5. Flexibility to meet renewable portfolio obligation

The national level tradability of renewable energy credits would allow distribution licensees to fulfil their obligation even on account of supply concerns due to natural vagaries, breakdown, delayed investment, etc. The first two cases may be exempted as a force majure condition, the risks on account of insufficient/delayed investments can be hedged through purchase of renewable energy credits in spot as well as futures

[4] Environmentally conscious consumers are willing to pay a premium for green electricity in the US [25]. Rising awareness and income levels in India may also influence behavioural preference for ‘green electricity’.

market. Such credits may be generated due to generation of electricity from renewable energy sources located in other states.

The tradable renewable energy credits would allow states with limited renewable energy resource endowments to stipulate higher RPO than the existing potential in the state.[5] For example, Delhi does not have sufficient scope for development of renewable energy in the state.[6] However, high energy intensity and growing environmental concerns may still allow the regulator to specify a reasonable RPO. While this may improve the state of local pollution, the state may be able to support development of renewable energy sources elsewhere in the country. Due to a favourable consumer mix in Delhi, the economic burden of such a regulatory gesture would not severely affect the consumer tariff.

6.6. Investment barometer

A futures market for renewable energy credits would provide appropriate signals for investment in development of renewable energy sources for electricity generation. Increasing price for the futures would signal growing demand for renewable energy credits and hence would signal further investment. The project developers investing in new renewable energy-based projects can hedge price risk through long positions in the futures market. While long-term bilateral contracts also provide a hedge against risk, their role would continue to dwindle in a competitive environment. Investors can also enter into futures contract for sale of physical electricity and hence hedge against volatility in electricity prices. An efficient market for electricity and for renewable energy credits would provide adequate risk hedging and encourage investment in development of renewable energy sources in the country.

6.7. Effective utilisation of government public support

The government agencies can provide more effective support for development of renewable energy by purchasing such credits annually thus complementing any existing regime of fiscal incentives, which can be removed later on. This could be more efficient than traditional subsidies and fiscal mechanisms made available to the sector in case the market for renewable energy credits functions efficiently and does not suffer from manipulation by speculative investors. Such a transfer of benefits would mean that the project developers would minimise cost of developing renewable energy sources, which otherwise tend to suffer from jacked up costs to garner high proportion of subsidies. The government is not always better placed to determine the level of support desirable for the sector. A predetermined budget can be utilised for direct purchase of renewable energy credits effectively transferring the financial support to investors in renewable energy projects.

6.8. Support to various technologies

The proposed renewable energy credit regime would be amenable to the presence of technology/source differentiated RPO prescribed by some of the SERCs. Depending on the relative normative cost of electricity generation from various technologies, and their lifecycle impact on environment and sustainability, a differential multiple of credits may be assigned to renewable energy credits accrued from various technologies. For example

- Wind: 1 Renewable Energy Credit;
- Solar PV: 1.5 Renewable Energy Credit;
- Biomass: 0.75 Renewable Energy Credit;

A less mature renewable energy technology can be provided with additional market support without the need of higher subsidies or additional fiscal incentives. This can be achieved easily by assigning higher equivalent credit for a limited duration till the technology matures. A similar approach can also be used to extend support to a number of applications that result in displacement of electricity thereby enhancing the footprint of renewable energy applications. For example solar water heaters, solar drying, etc. However, including such numerous applications may increase transaction cost of verification for eligible applications and the amount of credits earned. Since the RPO obligation falls within the purview of individual SERCs, a national policy outlining guidelines for assigning equivalent renewable energy credits needs to be worked out.

6.9. Reduced exposure to regulatory risk

The project developers for renewable energy sources would be have access to a national market, thereby limiting their exposure to regulatory risk arising out of policies of a single SERC. However, local purchase policies for electrical energy would continue to be influenced by the local SERC to the extent it is not feasible to cost effectively wheel the electricity outside the state.

6.10. Implementing sunset clause

Sunset clause can easily be implemented in a renewable credit regime by pre-specifying annual reduction in 'credit equivalence' multiplier over a few years. This can be effectively staggered differently across various technologies. For mature technologies, such a mechanism would effectively reduce additional revenue support from sale of renewable energy credits. This would also be in line with the National Electricity Policy that foresees renewable energy competing with conventional energy over time.

[5] Some of the smaller and more urbanised states in the US have also specified long-term targets for RPS (see Section 5). This is also backed up by trading regime for renewable energy credits [5].

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6.11. Effective compliance

Some of the SERCs have laid down a penalty for failure of the distribution licensees to meet the RPO (Table 1). Any shortfall in renewable energy obligation by the distribution licensee could be made good by purchase of 'renewable energy credits' from the market. This may obviate the need for a separate penalty mechanism for non-compliance as it can be set at a mark-up to the market price to effectively deter non-compliance. Even if the SERCs wish to keep the penalty clause the market price of the renewable energy credit together with the market price of electricity can be taken as a guideline for setting appropriate level of penalty for shortfall in meeting the RPO.

7. Implementation issues

The design of a nationally tradable renewable energy credit regime would require regulatory coordination and harmonisation among the SERCs. It would require setting up of an effective monitoring mechanism for accrual of credits, a national registry for credits and a trading platform. Unless such a market is designed properly with caps, penalties and banking provisions, price volatility could influence investment in renewable energy [26]. The scope for participation as buyers or sellers or both by generators, distribution companies, traders, corporate entities, individuals, etc., would influence the scope for price volatility. A debate on fixing the credit equivalence multiplier across technologies and the sunset clause would see lobbying interests from existing renewable energy generators and more so by the equipment suppliers.

With the exception of the Rajasthan Electricity Regulatory Commission, the SERCs discussed here have not put forward a road map to competitive bidding for procurement of electricity from renewable energy sources. The regulations related to RPO and the applicable terms and conditions issued by the SERCs are subject to review in the next 3–5 years, providing sufficient time to chart a road map to the introduction of a nationally tradable renewable energy credits regime. This could be affected by its inclusion in the National Electricity Policy. The successful implementation of the proposed regime would require an efficient monitoring and accreditation by a national level institution. This can be assisted through registration of all renewable energy-based projects. Any segmentation of the market on regional or state basis would dilute the liquidity in the market and also influence the ability of the market to determine efficient price for the credits. Liquidity concerns in the credits market in various US states have highlighted the need for a national jurisdiction for renewable energy credits [27]. Few challenges would arise for development of futures market for renewable energy sources generating in-firm power (e.g. wind, solar PV, etc.) as its deliverability and hence credit accrual cannot be assured beforehand. The divergence in resource endowments and the applicable RPO across states would also require a balancing act to address distributional issues to address renewable energy resource exploitation in the country.

8. Conclusions

Adoption of market-based instruments like emissions trading promises efficiency in compliance of CO_2 emission reduction target among the Annex-I countries to the Kyoto protocol. A similar situation prevails in the case of renewable portfolio obligation under implementation in various Indian states. The cost of compliance for such an obligation can be reduced through adoption of market-based approach like the proposed nationally tradable renewable energy credits. This would also be instrumental in promoting cost effective investment in the renewable energy in the country. In the existing regulatory regime of cost-plus tariffs, such a measure to reduce cost of power procurement would promote choice of appropriate technology and their optimal deployment. The identified advantages of such a regime merit consideration for its implementation in the countries adopting policies for promotion of renewable energy sources.

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